Call for Papers

Astronomical Telescopes and Instrumentation

The Industrial Revolution in Astronomy

21–25 June 2004
Scottish Exhibition and Convention Centre
Glasgow, Scotland United Kingdom

Symposium Chairs
Adrian Russell, UK Astronomy Technology Ctr. (United Kingdom)
Roberto Gilmozzi, European Southern Observatory (Germany)

Symposium Co-Chairs
Colin Cunningham, UK Astronomy Technology Ctr. (United Kingdom)
Jacobus Oschmann, National Solar Observatory (USA)

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Space Telescope Systems

Interferometry

Ground-based Telescopes

Advancements in Adaptive Optics

Ground-based Instrumentation

Information Technologies

Technology Advancements

Detector Advancements

SPIE The International Society for Optical Engineering

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Invitation to Participate

We are pleased to announce that the next SPIE Astronomical Telescopes and Instrumentation Symposium will take place in Glasgow, Scotland – a cradle of the 19th century Industrial and Scientific Revolution. Scotland has produced a wealth of eminent scientists and engineers who laid the foundations for the Astronomical Technology of today, including James Gregory, James Clerk Maxwell, Lord Kelvin, James Nasmyth, James Dewar and David Brewster. Scotland is now a centre for 21st century high-tech industry and development of telescopes and instrumentation for astronomy and gravitational wave research. As such, we are pleased that SPIE has chosen Glasgow to host the first visit of this symposium to the United Kingdom.

We live in exciting times for astronomy as great discoveries are being made with the new generation of facilities: space telescopes, the 8-10m ground-based telescopes and their adaptive optics systems, interferometers, submillimeter cameras, x-ray telescopes and gravitational wave facilities, but we know that the future will be even more exciting as we plan the next generation of giant ground and space-based observatories covering the spectrum from the ultraviolet to radio waves. We have learnt that the advances we require can only be obtained by strong partnerships with industry, and that will be even more so in the future. Hence we subtitle this symposium 'the Industrial Revolution in Astronomy' – an entirely appropriate theme for its site on the bank of the River Clyde.

Inspiring plenary presentations are planned to put the technology and engineering into the context of the science that drives our enterprise. We have planned each conference to take us from scientific goals, through the current state of the art through plans and ideas for the future. The 2004 symposium has been redesigned with fewer conferences to reduce overlap of related areas and allow more time and space for stimulating and informal discussion of poster presentations.

We hope the programme we have devised and the prospect of visiting the dynamic city of Glasgow – and the nearby delights of Edinburgh and the Scottish Highlands - stimulates you to submit exciting and high quality papers.

Make plans to be in Scotland next June!

Cooperating Organizations

AURA—Association of Universitites for Research in Astronomy

ESO—European Southern Observatory

OPTICON—Optical Infrared Coordination Network

PPARC—The Particle Physics and Astronomy Research Council

Scottish Enterprise

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SPIE's Event Project Manager for this symposium is Marilyn Gorsuch. For information about the technical program, email: meetinginfo@spie.org.

Hotel Accommodations

Information concerning hotel reservations, as well as a hotel reservation form, will be included in the Advance Technical Program available in March 2004.

Registration

Registration fees for conferences and short courses and registration form, will be available in the Advance Technical Program.

Student Travel Contingency Grants

A limited amount of student travel contingency grants will be awarded based on need. Grant applications can be found at http://www.spie.org/CommunityServices/StudentsAndEducators/ under the Scholarships & Grants section. Applications must be received no later than 10 weeks prior to the meeting.

Advance Technical Program

Available March 2004

The comprehensive Advance Technical Program for this symposium will list conferences, paper titles, and authors in order of presentation; an education program schedule, including course descriptions and instructor biographies; an outline of all planned special events; and information detailing the hotel reservations process. All those who submit an abstract will receive a copy, or contact SPIE to request a copy.

Letters of Invitation for Visa Process

Individuals requiring letters of invitation to obtain travel visas to present their papers may access and print an Invitation Letter Request Form found at this web site: http://spie.org/forms/invitationrequest.pdf

Please fill out a separate form for each person requesting a letter. All letters of invitation will be sent by airmail and by PDF e-mail attachment unless a courier account number or credit card number with expiration date is provided with the original request. Please allow ample time for processing requests. SPIE is not able to contact U.K. Embassies in support of an individual attempting to gain entry to attend an SPIE meeting. Because the application for a visa can be a lengthy process, we recommend that you start your visa application process as soon as you have been notified that your paper has been accepted. We also recommend that you secure your travel visa before registering for the symposium. Cancellations after the preregistration cutoff can result in a cancellation fee.

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Technology Advancements

Program Chair: **Colin Cunningham,** UK Astronomy Technology Ctr. (United Kingdom)

PROGRAM ON

Detector Advancements

Program Chair: **James Beletic,** W.M. Keck Observatory/California Association for Research in Astronomy (USA)

Call for Papers

Optical, Infrared, and Millimeter Space Telescopes (AS01)

Conference Chair:
John C. Mather
NASA Goddard Space Flight Ctr. (USA)

Cochairs:
Mark Clampin
NASA Goddard Space Flight Ctr. (USA)

Thijs W. de Graauw
Space Research Organization Netherlands (Netherlands)
Photo not available

Program Committee: **James B. Breckinridge**, Jet Propulsion Lab. (USA); **Lee D. Feinberg**, NASA Goddard Space Flight Ctr. (USA); **Silvano Fineschi**, Osservatorio Astronomico di Torino (Italy); **Matthew A. Greenhouse**, NASA Goddard Space Flight Ctr. (USA); **Matthew J. Griffin**, Univ. of Wales Cardiff (United Kingdom); **Hashima Hasan**, NASA HQ (USA); **Martin F. Kessler**, European Space Agency (Netherlands); **Oliver LeFevre**, Lab. d'Astrophysique de Marseille (France); **Knox S. Long**, Space Telescope Science Institute (USA); **Toshio Matsumoto**, Institute of Space and Astronautical Science (Japan); **H. Philip Stahl**, NASA Marshall Space Flight Ctr. (USA); **Saku Tsuneta**, National Astronomical Observatory of Japan (Japan); **Paul Wesselius**, Space Research Organization Netherlands (Netherlands)

Extraordinary technological advances have brought optical, infrared, and millimeter wave space telescopes to the forefront of astronomy and enabled increasingly detailed remote observations of the Earth. The Hubble Space Telescope has been operating since 1990, SOHO has been observing the Sun since 1995, Earth images are now commercially available and in routine military use, the Space Infrared Telescope Facility (SIRTF) is scheduled for launch in August 2003, the Solar-B telescope will fly in 2005, the Japanese ASTRO-F (IRIS) is in preparation, the Herschel and Planck observatories and the Kepler planet-finding mission are planned for launch in 2007, the Eddington Planet Finder and Stellar Physics Explorer is due for launch in 2008, the Wide-field Infrared Survey Explorer (WISE) and the GAIA mission to chart our galaxy in 3D will go in 2010, the James Webb Space Telescope (JWST) is planned for 2011, and the Solar Orbiter would fly in 2012. Concepts have been proposed for even more powerful space missions, including the SNAP Supernova Acceleration Probe, the Japanese SPICA far IR telescope, the SAFIR (Single Aperture Far IR) telescope, the SIRCE (Survey of Infrared Cosmic Evolution), coronagraphs and nulling interferometers like TPF, JPF, and Darwin to observe planets around other stars, spectrometers like the Astrobiology Explorer (ABE) to measure the chemical composition of the interstellar and circumstellar medium, better solar telescopes capable of resolving even finer details, and the GEST (Galactic Exoplanet Survey Telescope) using gravitational microlensing. New mirror technologies have been developed for JWST, stretched membrane mirrors and replicated optics are under development, and robotic assembly is being considered for some future missions. Earth observations with larger telescopes are being conceived for surveillance and scientific purposes, and this confluence of interests is continuing to support improved technology.

This Conference will provide a sequence of invited and contributed papers on a wide range of topics, including but not limited to:

- Highly Innovative Space Telescope Concepts
- Optical, IR, and Millimeter Space Telescopes & Instruments
- Innovative Telescopes & Instrumentation for Solar Astrophysics
- High-Contrast Imaging for Exo-Planet Detection.

Space Telescope Systems (UV-Gamma) (AS02)

Conference Chairs:
Günther Hasinger
Max-Planck-Institut für extraterrestrische Physik (Germany)

Martin J. L. Turner
Univ. of Leicester (United Kingdom)
Photo not available

Program Committee: **Xavier Barcons**, Instituto de Fisica de Cantabria (Spain); **Giovanni F. Bignami**, Ctr. d'Etude Spatiale des Rayonnements (France); **Johan M. Bleeker**, Space Research Organization Netherlands (Netherlands); **Webster C. Cash**, Univ. of Colorado/Boulder (USA); **Oberto Citterio**, Osservatorio Astronomico di Brera (Italy); **Mike Dopita**, Australian National Univ. Res. (Australia); **Kathryn A. Flanagan**, Massachusetts Institute of Technology (USA); **George W. Fraser**, Univ. of Leicester (United Kingdom); **Neil A. Gehrels**, NASA Goddard Space Flight Ctr. (USA); **Steven P. Jordan**, Ball Aerospace & Technologies Corp. (USA); **Chryssa Kouveliotou**, NASA Marshall Space Flight Ctr. (USA); **Shrinivas R. Kulkarni**, California Institute of Technology (USA); **Hideyo Kunieda**, Institute of Space and Astronautical Science (Japan); **Duccio Macchetto**, Space Telescope Science Institute (USA); **Warren Moos**, Johns Hopkins Univ. (USA); **Stephen S. Murray**, Harvard-Smithsonian Ctr. for Astrophysics (USA); **Arvind N. Parmar**, European Space Agency/ESTEC (Netherlands); **Robert Petre**, NASA Goddard Space Flight Ctr. (USA); **Volker Schönfelder**, Max-Planck-Institut für extraterrestrische Physik (Germany); **Oswald H. W. Siegmund**, Univ. of California/Berkeley (USA); **Timo Stuffler**, Kayser-Threde GmbH (Germany); **Martin C. Weisskopf**, NASA Marshall Space Flight Ctr. (USA); **Nicholas E. White**, NASA Goddard Space Flight Ctr. (USA)

Propelled by a new generation of ground- and space-based telescopes across the whole electromagnetic spectrum, astronomical research is currently in a "golden age". Exciting new discoveries are constantly changing and completing our view of the cosmos. In the high-energy domain, from UV to Gamma Ray wavelengths we are looking at the hot universe under the most violent and extreme conditions. The realization that most baryons in the local universe are in a warm/hot phase of the intergalactic medium, or that most galaxies contain supermassive black holes, which must have an important feedback on the formation and evolution of galaxies and large-scale structure, are just two new paradigms requiring high-energy space telescopes.

This conference seeks contributions about lessons learned from existing high-energy space facilities, the status of current projects, future science drivers for high-energy (UV-Gamma) astrophysics, as well as future projects and their technologies.

Ground-based Telescopes (AS03)

Conference Chair:
Jacobus M. Oschmann
National Solar Observatory (USA)

Cochair:
Massimo Tarenghi
European Southern Observatory (Germany)
Photo not available

Program Committee: **Torben B. Andersen**, Lund Univ. (Sweden); **James Roger P. Angel**, Steward Observatory and Univ. of Arizona (USA); **Charles F. Claver**, National Optical Astronomy Observatory (USA); **Xiangqun Cui**, National Astronomical Observatories (China); **Phil J. Diamond**, MERLIN/VLBI National Facility (United Kingdom); **Philippe Dierickx**, European Southern Observatory (Germany); **Robert Q. Fugate**, Air Force Research Lab. (USA); **Roberto Gilmozzi**, European Southern Observatory (Germany); **Kerstan G. Hermann**, VertexRSI (USA); **Ramsey K. Melugin**, NASA Ames Research Ctr. (USA); **Jerry E. Nelson**, Univ. of California (USA); **Tetsuo Nishimura**, National Astronomical Observatory of Japan (Japan); **Hans-Peter Roeser**, Univ. Stuttgart (Germany); **Michael Sigwarth**, Kiepenheuer-Institut für Sonnenphysik (Germany); **Larry M. Stepp**, AURA Inc. (USA); **Arnold van Ardenne**, Netherlands Foundation for Research in Astronomy (Netherlands)

Many groups around the world are evolving concepts for the next generation of telescopes. In this conference, we take time to postulate on the future scientific drivers giving context to the technology and engineering concepts required. Once we review these concepts, we take stock of existing facilities and the lessons learned in recent history. In between the present and the grand plans for the future are many projects building new telescopes or providing major upgrades to existing facilities that take advantage of lessons learned and will provide a continuous learning cycle for the future giants to extend upon. Throughout this process we see the ever-increasing role of industry to complement these efforts using large scale engineering and manufacturing in new ways, continuing to push the 'state-of-the-art'.

This conference solicits papers from the community and industry on existing, ongoing and future telescopes covering the optical, IR, millimeter and radio wavelength bands; from nighttime use to daytime and solar facilities. We are organizing the conference around the following four general themes for ground and airborne-based systems:

- Future science drivers for ground based telescopes
- Future projects and technology, including:
  - Overwhelmingly Large Telescope (OWL)
  - Euro – 50 Telescope
  - California Extremely Large Telescope (CELT)
  - 20/20
  - Giant Segmented Mirror Telescope (GSMT)
  - Arcetri 40-m mulitconjugate telescope
  - Low Frequency Array (LOFAR)
  - Allan Telescope Array (ATA)
  - Square Kilometre Array (SKA)
  - Atacama Large Millimeter Array (ALMA)
  - Chinese Future Giant Telescope (CFGT)
  - Other future ground or airborne-based ideas
- Existing facilities and lessons learned
- Current telescope projects:
  - SOFIA
  - VISTA
  - LBT
  - ATST
  - LAMOST
  - GREGOR
  - and many others.

Papers are solicited concerning, but not restricted to, the following topics:

- future science drivers for high-energy space missions
- current missions in UV, X-ray and gamma-ray astronomy, lessons learned (HST, RXTE, FUSE, Chandra, XMM-Newton, HETE-2, RHESSI, GALEX, INTEGRAL)
- the status of upcoming missions (SWIFT, CHIPS, AGILE, Astro-E2, GLAST, SPEAR)
- proposed small to moderate missions (ROSITA, LOBSTER, NeXT, EXIST, SIMBOL-X)
- Future large facilities (Constellation-X, XEUS, SUVO, ACT, MAXIM, Generation-X)
- Telescope Optics (grazing incidence, lobster eye, multilayer, diffractive spectrometers, interferometers, coded mask, Bragg lensing, Fresnel zone plates, Compton telescopes)
- Focal Plane Instrumentation.

IMPORTANT DATES!

Abstract Due Date: 24 November 2003

Manuscript Due Date: 24 May 2004

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Call for Papers

Advancements in Adaptive Optics (AS04)

Conference Chairs:
Domenico Bonaccini European Southern Observatory (Germany)

Brent L. Ellerbroek
AURA New Initiatives Office (USA)

Roberto Ragazzoni
Osservatorio Astrofisico di Arcetri (Italy)

Program Committee: **Mark R. Chun**, Institute for Astronomy/Univ. of Hawaii (USA); **Richard I. Davies**, Max-Planck-Institut für extraterrestrische Physik (Germany); **Richard G. Dekany**, California Institute of Technology (USA); **Simone Esposito**, Osservatorio Astrofisico di Arcetri (Italy); **Robert Q. Fugate**, Air Force Research Lab. (USA); **Donald T. Gavel**, Lawrence Livermore National Lab. (USA); **Norbert N. Hubin**, European Southern Observatory (Germany); **Michael Lloyd-Hart**, Steward Observatory and Univ. of Arizona (USA); **Richard M. Myers**, Univ. of Durham (United Kingdom); **Francois J. Rigaut**, Gemini Observatory (USA); **Gerard Rousset**, ONERA (France); **Goran Scharmer,** Royal Swedish Academy of Sciences (Sweden); **Hideki Takami**, Subaru Telescope and National Astronomical Observatory of Japan (Japan); **Laird A. Thompson**, Univ. of Illinois/Urbana-Champaign (USA); **Jean-Pierre Veran**, National Research Council Canada (Canada); **Peter L. Wizinowich**, W.M. Keck Observatory (USA)

As single natural guide star (NGS) Adaptive Optics (AO) is becoming routine at several 8-10m-class telescopes, and single laser guide star (LGS) AO systems are coming online, scientific results and maturing field experience are being collected. One of the goals of this conference is to distribute this knowledge.

Still, many further advances will be needed to make whole sky, wide field of view, and/or extreme AO (XAO) available for the current generation of telescopes and future Extremely Large Telescopes (ELTs). For the moment only conceptual system designs, abstract theory, and simulation results have been developed and presented.

Further progress will require new concepts, their theoretical, numerical, laboratory and on-sky demonstration, and finally, for the most mature concepts, their realization into projects designed to routinely deliver scientific imaging and spectroscopy at the diffraction limit.

Besides existing NGS or single LGS-AO systems, we would like this conference to cover these new ideas, concepts, demonstrations, and consolidated projects that are aiming to explore the edges of AO in Astronomy, and which may quite possibly revolutionize our view of astronomical telescopes, instrumentation and achievable science.

Examples of the topics we would like to explore in this conference, through talks, discussions, and working groups, include (but are not limited to) the ultimate exploitations of Laser Guide Stars (LGS) and Natural Guide Stars (NGS) to achieve homogeneous, nearly whole sky, diffraction limited imaging over large patches of the sky at the focus of Extremely Large Telescopes, the design of Deformable Mirrors (DM) with millions of actuators, the potential exploitation for AO of other technological novelties that may be revolutionary as well, such as zero read-out-noise detectors, high power fiber lasers, nano-technologies, and advanced signal processors.

Papers are solicited in the following areas:

- Results and experience from running facility AO systems and instruments, including LGS-AO systems
- Novel ideas and concepts for AO in Astronomy
- Wide Field AO: projects and concepts
- Novel concepts for AO on ELTs
- Lasers and LGS systems for AO
- XAO for Large and ELTs
- Laboratory and on-sky demonstration of novel concepts and techniques
- Advances in other component technologies, control algorithms, and modeling methods for AO.

New Frontiers in Stellar Interferometry (AS05)

Conference Chair:
Wesley A. Traub
Harvard-Smithsonian Ctr. for Astrophysics (USA)

Cochairs:
John D. Monnier
Univ. of Michigan (USA)

Markus Schöller
European Southern Observatory (Chile)

Program Committee: **Andrew F. Boden**, California Institute of Technology (USA); **David F. Buscher**, Univ. of Cambridge (United Kingdom); **William C. Danchi**, NASA Goddard Space Flight Ctr. (USA); **G. Charmaine Gilbreath,** Naval Research Lab. (USA); **Philip M. Hinz**, Steward Observatory and Univ. of Arizona (USA); **Christian A. Hummel**, European Southern Observatory (Chile); **Ulrich Johann**, Astrium Germany (Germany); **Steven Kilston**, Ball Aerospace & Technologies Corp. (USA); **Peter R. Lawson**, Jet Propulsion Lab. (USA); **Fabien Malbet**, Lab. d'Astrophysique de Grenoble (France); **Harold A. McAlister**, Georgia State Univ. (USA); **Guy S. Perrin**, Observatoire de Paris-Meudon (France); **Peter G. Tuthill**, Univ. of Sydney (Australia); **Gerd Weigelt**, Max-Planck-Institut für Radioastronomie (Germany)

We invite you to join us in celebrating the dawn of a new age in astrophysics enabled by large telescope-interferometers, space interferometry, and multi-beam interferometers operating at visible and infrared wavelengths. If you want to learn what is happening in interferometry and how it is revolutionizing the ways we observe on the ground and in space, you must come to this conference.

Recent technology advances in interferometry are opening up exciting new areas of astrophysical research. Ground-based interferometers using large telescopes recently measured extragalactic sources for the first time. Smaller telescopes ganged together with new beam-combination methods are making the first closure-phase observations of stars and their surroundings. Space interferometers being built, and those planned, will permit us to observe Earth-like planets around nearby stars. Antarctic interferometers are being seriously discussed.

This conference will primarily focus on the latest in technology and engineering for ground and space-based interferometry in the optical and

Ground-based Instrumentation (AS06)

Conference Chairs:
Alan F. M. Moorwood
European Southern Observatory (Germany)

Masanori Iye
National Astronomical Observatory of Japan (Japan)

Program Committee: **Roland Bacon**, Observatoire de Lyon (France); **James H. Hough**, Univ. of Hertfordshire (United Kingdom); **Ian S. McLean**, Univ. of California/Los Angeles (USA); **Suzanne K. Ramsay Howat**, U.K. Astronomy Technology Ctr. (United Kingdom); **Douglas A. Simons**, Gemini Observatory (USA); **Keith Taylor**, California Institute of Technology (USA); **Oskar von der Lühe**, Kiepenheuer-Institut für Sonnenphysik (Germany)

The many ground-based telescope projects completed over the last decade have generated both the corresponding needs and resources behind the current Golden Age of instrumentation development. Particularly the large 8-10m class telescopes such as Keck, VLT, Subaru, Gemini, and HET together with the recent growth in the formats of optical and infrared detectors have also led to an increase in the size and engineering complexity of many of these instruments to a level that well illustrates the 'Industrial Revolution in Astronomy' theme of our meeting. The pursuit of new techniques e.g. in the area of multi-object/3D spectroscopy continues and ideas are already emerging on how to optimally approach the challenges of instrumenting even larger telescopes with apertures of 30m or more in the future.

This conference aims to provide: i) an overview of the performance and lessons learned from those instruments already in operation [largely through invited reviews for the major observatories]; ii) an insight into the design and status of future instruments proposed, planned or already in development; iii) a forum for the exchange of more detailed information on both achievements and problems amongst instrument builders in both the academic and industrial worlds.

Papers (oral and poster) are welcome on essentially all aspects of ground-based UV, optical and infrared astronomical instrumentation (except those on detectors and some advanced technology issues for which one of the other, more specialized conferences, may be more appropriate). Specific areas of interest are:

infrared, including new instrumentation and software. A secondary theme will be exploring the motivating science that is made possible with milli- and micro-arcsecond angular resolution.

Topics to be covered include:

- astrometry
- imaging
- nulling
- phase closure
- wavefront control
- fringe tracking
- beam combination
- visible and infrared wavelengths
- cryogenic mechanisms
- atmospheric effects
- aperture masking
- fiber optics
- integrated optics
- single-mode and spatial filters
- control algorithms
- precision calibration and high dynamic range methods
- image reconstruction algorithms
- data interpretation
- modeling
- interferometer sites (including Antarctica)
- star tracking
- picometer metrology
- current and planned instrumentation
- present and future facilities on the ground and in space.

We solicit contributed papers on these and related topics. We ask that papers briefly mention the relevant science application, if any, but otherwise concentrate on technology. Since the meeting will be concentrated into 2.5 days, the committee will actively assign contributed papers to be either oral or poster, unless the author requests poster presentation. We plan to have a number of invited papers as well; topics and authors will be announced later. All presenters will be asked to provide a camera-ready manuscript for publication in a proceedings volume to be published soon after the conference.

- performance and lessons learned from existing instrumentation
- design/status of new instruments - imagers, spectrographs, polarimeters
- new components/techniques e.g. IFUs, polarisers, grisms, active control
- specialist instruments for ground-based solar telescopes
- instrumentation for future Extremely Large Telescopes.

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Call for Papers

Optimizing Scientific Return Through Information Technologies (AS07)

Conference Chairs:
Peter J. Quinn
European Southern Observatory (Germany)

Alan Bridger, UK Astronomy Technology Ctr. (United Kingdom)

Program Committee: **Benoît Pirenne**, European Southern Observatory (Germany); **David Silva,** European Southern Observatory (Germany); **Alexander Szalay**, Johns Hopkins Univ. (USA)

Astronomy at the beginning of the 21st century will be dominated by a new generation of large telescopes on the ground and in space (Gemini, JWST, Subaru, VLT, ALMA). In addition, there are a number of planned (or currently operational) dedicated survey telescopes and instruments (e.g. SLOAN, VST, VISTA, WFCAM, WIRCAM, Megacam) which will produce terabyte and petabyte sized data archives. The full exploitation of the new facilities will be dependent on the use of Information Technologies.

Efficient operation of these facilities is crucial to ensuring the maximum scientific return. Increasingly observatory and instrument operations are dependent upon IT for essential underlying infrastructures and the astronomer's interface to the data. Furthermore, the plans for Extremely Large Telescopes (ELTs) may require new approaches to telescope operations, certainly based on advanced software technologies.

Data reduction and analysis technologies are crucial for the optimal functioning of observatory facilities in astronomy, providing calibrated data rapidly and supplying the quality assurance necessary in these large operations. The rapid evolution of technologies related to telescopes and instrumentation is being complemented by the "new astronomical data analysis environment" based around large surveys and major information services.

Virtual Observatories, based on grid technologies, will be an essential tool to fully exploit the information contained in these databases: The VOs will provide the processing and storage capabilities necessary for astronomers to analyse and explore the datasets and will help explore the scientific gold mine that will be available by connecting and unifying the archives and supplying data mining tools that will create a new type of astronomy.

Papers are solicited on a wide range of topics related to the conference title, including, but not limited to, the following:

- Virtual Observatory & GRID developments and applications
- Advanced data analysis techniques, image processing, visualisation
- Large scale data management
- High performance computing - applications
- Remote operations, scheduling, networks
- Use of autonomous agents in information flow
- Large scale survey software & systems, including Quality Assurance
- Proposal preparation
- Observatory operations quality metrics and quality control
- New operational systems and challenges for ELTs and other large facilities.

PROGRAM ON

Technology Advancement

Program Chair:
Colin Cunningham
UK Astronomy Technology Ctr. (United Kingdom)

Optical Fabrication, Metrology, and Material Advancements (AS08)

Conference Chairs:
Eli Atad-Ettedgui
UK Astronomy Technology Ctr. (United Kingdom)

Philippe Dierickx
European Southern Observatory (Germany)

Program Committee: **Magomed A. Abdulkadyrov**, JSC Lytkarino Optical Glass Plant (Russia); **Michel Bougoin**, BOOSTEC Industries (France); **James H. Burge**, Univ. of Arizona (USA); **Roland Geyl**, SAGEM SA (France); **Peter Hartmann**, Schott Glas (Germany); **Matthias R. Krödel**, ECM GmbH (Germany); **Graham Peggs**, National Physical Lab. (United Kingdom); **Eric Prieto**, Lab. d'Astrophysique Marseille (France); **David Rimmer**, OpTIC Technium (United Kingdom); **David J. Robertson**, Univ. of Durham (United Kingdom); **Paul Shore**, Cranfield Univ. (United Kingdom); **Matthias Tecza**, Max-Planck-Institut für extraterrestrische Physik (Germany); **David D. Walker**, Univ. College London (United Kingdom); **Martyn Wells**, U.K. Astronomy Technology Ctr. (United Kingdom)

The next generation of astronomical telescopes and their instrumentation requires fundamentally new technological and industrial approaches. Thus, an 'industrial revolution' in astronomy will happen in the near future. The optical design of the new generation of survey and giant telescopes require very fast mirrors. Moreover, the making of these telescopes relies on mastering major design and technological challenges, one of which is the production of giant primary mirrors (with up to thousands of large segmented mirrors of 1 to 2-m size) which need to be reliably manufactured and tested over several years. Both the optical fabrication and metrology of these mirrors are very demanding tasks and an interdisciplinary approach between the Astronomers, Optical and Mechanical Designers as well as Production Engineers is necessary.

Novel materials may provide cost- and performance-effective alternatives to classical ones, the traditionally high cost of the former being alleviated by the implications of mass-production. New coating techniques may provide major efficiency breakthroughs as well.

The Instrumentation associated to these telescopes is very challenging as well and requires a new approach in manufacturing lenses, filters and image slicers.

This Conference provides an opportunity for presentations and discussions on all the aspects of Optical Fabrication, Metrology and Material Advancements. Potential topics to be addressed in this Conference include, but are not limited to, the following:

- Large Mirror Fabrication, serial production of segments
- Surface and Optical Material Metrology
- New Optical Materials
- Large Lenses Fabrication
- Small and micro-optics: lenslet arrays, image slicers
- Gratings manufacturing
- VPH and CGH manufacturing and testing
- IR and Visible Filter manufacturing
- Optical Coatings (AR and Reflective coatings).

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Technology Advancement *continued*

Structures and Mechanisms Technology (AS09)

Conference Chairs:
Joseph Antebi
Simpson Gumpertz & Heger Inc. (USA)

Dietrich Lemke
Max-Planck-Institut für Astronomie (Germany)
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Program Committee: **Daniel R. Blanco**, MMT Observatory (USA); **Alfonso Feria**, Jet Propulsion Lab. (USA); **Thomas E. Hoffman**, Hoffman Design & Development (USA); **Hans J. Kaercher**, MAN Technologie AG (Germany); **Bernardo C. Lopez**, Jet Propulsion Lab. (USA); **David Montgomery**, UK Astronomy Technology Ctr. (United Kingdom); **David R. Smith**, MERLAB, P.C. (USA)

Astronomers and scientists around the world continue to demand better telescopes to collect more light and produce better images. There are now a number of ground-based optical/IR telescopes in the 8 to 10 meter class that have recently come into operation or are approaching completion. In view of the length of time between the initiation and completion of a new class of telescope there are a number of projects underway to develop the next generation of telescopes ranging from 25 to 100 m. Large radio telescopes with active surfaces are currently under construction or in early phases of operation, and the next generation of extremely large telescopes is being planned. Additionally, large antenna arrays are currently being developed for astronomy and spacecraft tracking. In addition to the many challenges faced in designing and building telescopes, are those of designing and building instrumentation to exploit their potential.

The situation is similarly challenging for space-based astronomy. Due to the limited transportation volume and mass, large space telescopes need highly reliable deployment mechanisms combined with sensors and actuators for their figuring, all to be operated in the space cryovacuum. Space focal plane instruments combine many observing modes in a very limited volume and therefore require a diversity of precise optical cryomechanisms to be operated with a minimum of power.

As we embark on developing the structures and mechanisms for these sophisticated and ever more complex telescopes and their instrumentation, it is appropriate that we examine the state-of-the-art, the lessons learned, the new tools available, and explore what may lie for the future of this ever-growing area.

This is the first conference at an SPIE Astronomical Telescope Meeting devoted to Structures and Mechanisms. Papers are welcome on all aspects of structures and mechanisms related to ground and spaced based astronomical telescopes, instrumentation, and supporting facilities. Areas of interest include, but are not limited to, the following:

- Novel and "conventional" antenna/telescope structural configurations
- Primaries for optical/IR telescopes, segmented and monolithic
- Reflector panels for radio telescopes
- Telescope enclosures, contamination control/ cleanliness
- Use of high performance composite materials
- Smart structures and gossamer structures
- Bearing systems: wheel-on-track, hydrostatic, roller bearings, flex-pivots, other
- Drive systems
- Actuators, motors for cryovacuum
- Design, simulation & manufacture
- Assembly, handling, and testing
- Reliability/Maintainability strategies and analysis
- Subreflector/secondary mirror supports and position control
- Hexapods, choppers, and wobblers
- Active control of primary and secondary reflectors/mirrors
- Thermal deformations and temperature control
- Vibration sensing and control
- Position sensors and metrology systems
- Wind effects on telescopes
- Cryomechanisms
- Cryogenic optical mounts
- Tribology
- MicroOptoElectroMechanical Systems (MOEMS)
- Seismic, shock and launch protection
- Tests of large structures for zero-gravity applications.

Advanced Software, Control, and Communication Systems (AS10)

Conference Chairs:
Hilton Lewis
W.M. Keck Observatory/ California Association for Research in Astronomy (USA)

Gianni Raffi
European Southern Observatory (Germany)

Program Committee: **Robert I. Kibrick**, Univ. of California/Santa Cruz (USA)

The demands of modern telescopes and instruments have become ever more taxing. Systems are being scaled up exponentially in size and number of elements at the same time that precision of control is becoming ever more exacting. Detectors and sensors generate huge volumes of data and telemetry rates that would have been regarded as staggering just a few years ago are the norm. Containing costs as programs become larger and more complex requires highly efficient development and operation. Simultaneously, developments in software and computer hardware have continued at a furious pace. Computers are embedded in the most mundane devices; network-ready smart actuators and sensors are readily and cheaply available. Software development environments, frameworks, tools and libraries proliferate. The web is everywhere. This dazzling array of technology should guarantee that we could tackle larger and more complex programs in less time and at lower cost. Unfortunately, our ability to deal with ever more complex systems has not evolved at anything near this rate. Indeed, advances in software and hardware technologies continue to outstrip our ability to capitalize on them. Although there are examples of successful development and implementation of systems, they have been neither cheap to build nor rapid to deploy; in fact, the opposite is generally the case.

Yet to exploit technology advances while containing costs, shorter and more effective development cycles are essential. Equally important is the successful exploitation of our human capital – enabling diverse, highly mobile, geographically dispersed groups and individuals to interact effectively in building these new systems. The challenge is to achieve this with a vision of how these technologies will unfold. If we are successful in this endeavor, we will enable the current "Golden Age" of astronomy to come to full flower, with the successful deployment of the next generation of telescopes and instrumentation.

Modelling and Systems Engineering (AS11)

The focus of this conference will be to discuss technologies, techniques, designs and strategies to meet the challenges outlined above. Themes of the conference will be the development of high performance, reliable and effective systems, cost- and time-efficient development and maintenance, novel technologies and techniques and next generation telescopes and instrumentation.

Papers are solicited on a range of topics including, but not limited to the following areas of optical, infrared and radio telescopes:

- Software engineering
  - Standardization efforts for telescope and instrumentation software
  - Software project management and cost estimation
  - Quality control
  - Integration and test
- Software design and implementation issues
  - Software development environments and tools
  - Design patterns for astronomical software
  - Frameworks for distributed control and data acquisition
  - Achieving design re-use
  - Designing for effective user interaction
  - Rapid prototyping
  - Intelligent software agents and peer-to-peer
- Next generation telescopes
  - Computational, control and development issues pertaining to extremely large telescopes (ELTs) and arrays of telescopes
  - Scalability of current designs and technologies
  - Robotic Telescopes
- Telescope and instrumentation control
  - Real-time control software and hardware for control and data acquisition
  - New approaches to telescope pointing, tracking and guiding
  - Fault tolerance and reliability engineering
  - Development of secure control systems
  - Challenges of re-engineering
- Tools and environments to support collaborative development and research
  - Setting up successful distributed collaborations
  - Collaborative remote observing
  - Collaborative interactive development
- Communication
  - Global communication technologies
  - Innovative network and computer architectures
  - Video conferencing technologies
  - Secure and reliable remote observing
  - High performance, high capacity networked communication.

Conference Chairs:
Simon C. Craig
VISTA Project/UK Astronomy Technology Ctr. (United Kingdom)

Martin J. Cullum
Head of the Technology Division/European Southern Observatory (Germany)

Program Committee: **Torben B. Andersen**, Euro50/Lund Univ. (Sweden); **George Z. Angeli**, Thirty Meter Telescope Project/AURA New Initiatives Office (USA); **Pamela S. Davila**, JWST, ISIM Optical Systems Engg/NASA Goddard Space Flight Ctr. (USA); **Richard G. Dekany**, CELT/California Institute of Technology (USA); **Christoph Haupt**, ALMA/European Project Office (Germany); **Bertrand Koehler**, VLTI/European Southern Observatory (Germany); **Alan Smith**, Director, Ctr for Systems Engg/Univ. College London (United Kingdom)

Taking a systems approach to project development starts at the top-level requirements and ensures that the final delivered product meets these and the user's expectations. By scrutinizing the project from conception to delivery, the Systems Engineer ensures the project will be both scientifically rewarding and achievable.

Systems Engineering has existed in space astronomy projects since the very first missions and should be at the core of all astronomy technology projects. The great advances in ground-based telescope engineering have increased dependence on Systems Engineering. As projects grow larger and international collaborations are the norm, the dependence on System Engineering is greater than ever.

This conference is new to the SPIE Astronomical Telescopes & Instrumentation Symposia and is an opportunity to promote systems engineering practice and raise awareness of systems engineering in astronomy projects past, present and future. There are two focuses to the conference: Systems Modelling and Systems Engineering Practice. Papers are invited covering any aspect of these relevant to astronomical technology projects

Systems Modeling Sessions will include, but not be limited to, the following areas:

- Performance modeling
- End-to-End modeling
- Methods and tools for modeling of opto-mechanical systems, control systems, thermal modeling, disturbance modeling, etc.
- Model Validation

Systems Engineering Practice will include, but not be limited to, the following areas:

- Applying Systems Engineering to Astronomy Projects
- Introducing Systems Engineering as a discipline
- Collaborative Projects, systems benefits and complications
- Requirements Capture and Analysis
- Budgetary allocation and management
- Systems trade-offs
- Configuration Control
- System verification
- Lessons learned.

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Manuscript Due Date: 24 May 2004

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PROGRAM ON

Detector Advancement

Program Chair:
James Beletic
W.M. Keck Observatory/ California Association for Research in Astronomy (USA)

Millimeter and Submillimeter Detectors (AS12)

Conference Chairs:
Jonas Zmuidzinas
California Institute of Technology (USA)
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Wayne S. Holland
U.K. Astronomy Technology Ctr. (United Kingdom)

The mm/submm/far-infrared wavelength region has emerged in recent years as one of the most important for astrophysics, especially for answering fundamental origins questions, such as the geometry and mass/energy content of the Universe, and how planets, stars, and galaxies form. As an example, the far-IR/submm background discovered by the COBE satellite has been shown to be composed of high-redshift ultraluminous dusty galaxies, providing new insights into galaxy formation and evolution in the early Universe. Following such high profile discoveries, a new generation of powerful telescope facilities are rapidly being developed to exploit the new emerging science. Examples include the space missions Herschel, Planck, and SPICA; the new airborne observatory SOFIA; the 64-element mm/submm interferometer ALMA; and new single-aperture telescopes such as APEX, ASTE, SPT, and LMT. These facilities will be equipped with powerful new instruments, including large-format cameras, polarimeters, and spectrometers. Ambitious space projects are being planned for the next decade, such as a 10m-class cold single-aperture telescope, and a mission to study the polarization of the microwave background.

Astronomical detectors for this wavelength regime are undergoing an "industrial revolution" of their own. Less than 10 years ago the few instruments available had primarily single-pixel devices - often with poor noise performance. Nowadays, background-limited arrays with hundreds of pixels are available and in use on telescopes, and the possibility of IR-style imaging arrays with many thousands of pixels is no longer just a dream. These dramatic, exponential advances in detector capability provide the fuel to drive the field forward rapidly.

This conference aims to bring together astronomers, physicists, and engineers working on detectors and instruments for this wavelength range. It will cover the physics of semiconductor and superconductor devices, current and future imaging arrays for ground-based and space-borne telescopes, new developments in coherent receivers and spectrometers, and the design and optimization of instrument components such as optics, filters, and local oscillators. As arrays progress to larger and larger formats the signal readout and multiplexing scheme is becoming one of the most critical areas. A significant fraction of the conference will also be devoted to emerging concepts, such as new types of detectors, arrays and components for polarimetry, and antenna-coupled detectors.

Oral and poster contributions are welcome from academic, industrial, and government laboratories in the following subject areas:

- Performance requirements and science drivers
- Detector physics and fabrication techniques
- Imaging arrays
- Signal readout and multiplexing technology
- Coherent receivers and spectrometers
- Components and materials (optics, filters, LOs, etc.)
- Instrument architectures and design methodologies
- Coolers and cryogenics
- Emerging concepts.

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Optical and Infrared Detectors (AS13)

Conference Chair:
James Beletic
W.M. Keck Observatory/
California Association for
Research in Astronomy (USA)

Cochair:
James D. Garnett
Rockwell Scientific Co. (USA)

Program Committee: **Barry E. Burke**, Massachusetts Institute of Technology (USA); **Mark Clampin**, NASA Goddard Space Flight Ctr. (USA); **Gert Finger**, European Southern Observatory (Germany); **Alan W. Hoffman**, Raytheon Vision Systems (USA); **Paul R. Jorden**, e2vtechnologies (United Kingdom); **Gerard A. Luppino**, Univ. of Hawaii (USA); **Satoshi Miyazaki**, National Astronomical Observatory of Japan (Japan); **Ali Mohammadzadeh**, European Space Agency (France)

In the 34 years since the invention of the CCD, optical detectors have been nearly perfected. CCD arrays now achieve over 90% quantum efficiency, 2 electrons readout noise, high linearity, large dynamic range, and hundreds of millions of pixels in large mosaic focal planes. But the CCD still has room for improvement: advancements are being made in UV and far red quantum efficiency, less charge diffusion, lower noise amplifiers and "designer detectors" that are customized to specific applications.

Meanwhile, the CCD's reign in optical detection is being challenged by new technologies: monolithic and hybrid CMOS designs hold promise of providing large arrays with several advantages over the traditional CCD.

Infrared detector performance is not far behind that of the optical detectors. Focal plane mosaics of 16 million pixels are under construction, quantum efficiency is over 80% and readout noise can be as low as 3-5 electrons with multiple sampling. Advancements are being made in quantum efficiency, cutoff wavelength tuning and mosaic technology development.

This conference provides a forum for the new advancements in optical and infrared detectors to be presented and discussed. This is the first time in 4 years that the SPIE Astronomical Telescopes and Instrumentation symposium will host an optical / infrared detector conference: research groups and manufacturers are encouraged to provide a status report and prognosis for their work. This conference will provide ample time for discussion and interaction between participants. Thus, the format will encourage an overview presentation from each major organization with poster papers that present the details of projects within each organization. Every poster paper will be given oral presentation time to provide a brief summary on the paper content.

Contributions are sought in the following areas:

- Status reports from detector manufacturers
- Advancements in optical / infrared detector design and fabrication
- Advancements in quantum efficiency technologies
- Novel detector designs
- Detector mosaic technologies
- Ultra-low noise amplifier development
- Advancements in detector electronics
- Unique applications of optical / infrared detectors.

Detector Advancement *continued*

Gravitational Wave and Particle Astrophysics Detectors (AS14)

Conference Chairs:
James Hough
Univ. of Glasgow (United Kingdom)

Gary H. Sanders
California Institute of Technology (USA)

Program Committee: **Peter L. Bender**, Univ. of Colorado/Boulder (USA); **Alain Brillet**, Observatoire de la Côte d'Azur (France); **John Bryden**, Span Optic Ltd. (United Kingdom); **Sasha Buchman**, Stanford Univ. (USA); **Robert L. Byer**, Stanford Univ. (USA); **David Caldwell**, Univ. of California/Santa Barbara (USA); **Eugenio Coccia**, Univ. degli Studi di Roma Tor Vergata (Italy); **Adrian M. Cruise**, University of Birmingham (United Kingdom); **Karsten Danzmann**, Max-Planck-Institut für Gravitationphysik (Germany) and Univ. Hannover (Germany); **Joseph A. Giaime**, Louisiana State Univ. (USA); **Adalberto Giazotto**, Istituto Nazionale di Fisica Nucleare (Italy); **Peter W. Gorham**, Univ. of Hawaii/Manoa (USA); **Richard L. Hahn**, Brookhaven National Lab. (USA); **Seiji Kawamura**, National Astronomical Observatory of Japan (Japan); **Jeffrey D. Kmetec**, Lightwave Electronics Corp. (USA); **Marvin L. Marshak**, Univ. of Minnesota (USA); **Robert J. Paulos**, Univ. of Wisconsin/Madison (USA); **Norna A. Robertson**, Univ. of Glasgow (United Kingdom); **Sheila Rowan**, Stanford Univ. (USA); **Vernon D. Sandberg**, Los Alamos National Lab. (USA); **Peter Saulson**, Syracuse Univ. (USA); **David H. Shoemaker**, Massachusetts Institute of Technology (USA); **Kenneth Strain**, Univ. of Glasgow (United Kingdom); **Timothy J. Sumner**, Imperial College of Science, Technology and Medicine (United Kingdom); **Massimo Tinto**, Jet Propulsion Lab. (USA); **Stefano Vitale**, Univ. degli Studi di Trento (Italy)

The field of Particle Astrophysics, including Gravitational Wave Detection, is becoming one of the most exciting and productive in experimental and observational physical science.

- Already the discovery of neutrino oscillations is illuminating the solar neutrino problem
- A global array of diverse particle detectors is poised to address a broad spectrum of sources
- The first results from the long baseline gravitational wave detectors are about to result in astrophysically interesting upper limits to gravitational wave emission from a range of potential sources, and
- The LISA space based gravitational wave experiment, already approved as an ESA Cornerstone mission, is in the President's budget for funding in the USA.

This conference aims to engage a wide range of investigators working in the areas of instrument development for searches for ultra high energy particles, neutrinos, dark matter particles, and gravitational waves from the creation and merging of black holes, from black hole and neutron star coalescence, from pulsars and from violent processes in the early Universe.

Potential topics for this conference include:

- neutrino and muon telescopes and arrays
- optical Cherenkov particle tracking detectors
- extensive air shower detectors: air fluorescence, particle arrays
- radio detection techniques and instrumentation
- low-energy detectors for solar or supernova neutrinos
- novel approaches: fiber-optics, acoustic
- axion and other dark-matter detectors and search techniques
- simulation techniques and results for particle astrophysics
- present and next-generation giant air shower arrays
- spacecraft- and balloon-borne techniques and instruments
- laser interferometry for the detection of gravitational waves in space
- drag-free Spacecraft, inertial sensors, laser readout systems, micro-newton thrusters, spacecraft stability, in-orbit testing
- spacecraft doppler detection, Cassini data, transponder design, mission scenarios
- pulsar timing, pulsar searches, pulsar properties, inherent timing noise
- current low temperature bar and interferometric gravitational wave experiments
- data analysis techniques, results of recent observations and plans for new observations
- advanced resonant detectors, advanced interferometers
- astrophysics of gravitational wave sources
- links to electromagnetic astronomy
- interpretation of signals for relativistic physics
- numerical relativity
- detector physics.

High Energy Detectors in Astronomy (AS15)

Conference Chair:
Andrew D. Holland
Univ. of Leicester (United Kingdom)

Cochair:
Lothar Strüder
Max-Planck-Institut für extraterrestrische Physik (Germany)
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Program Committee: **Mark W. Bautz**, Massachusetts Institute of Technology (USA); **Carl Budtz-Joergensen**, Danish Space Research Institute (Denmark); **Piet A. J. de Korte**, Space Research Organization (Netherlands); **Fiona A. Harrison**, California Institute of Technology (USA); **Alan Owens**, Aurora (Netherlands); **Peter J. Pool**, e2v Technologies (United Kingdom); **Tadayuki Takahashi**, Institute of Space and Astronautical Science (Japan); **Hiroshi Tsunemi**, Osaka Univ. (Japan)

Since the first rocket experiments probed the high energy sky, continual improvements in detector technology have brought about huge advances in the sensitivity and quality of imaging and spectroscopic data collected on astrophysical objects. With the successful operation of the current observatories (Asca, XMM, Chandra, Integral) comes the development of next-generation instrumentation having larger area, broader energy coverage, and higher spectral resolution. Several new high-energy observatory concepts are already being proposed to take advantage of the new technologies (XEUS, Con-X, Gen-X, NeXT) plus a range of small "opportunity" missions.

This conference aims to provide a forum for scientists and engineers who are developing the detection technologies. It will cover new detector technologies currently under development for near-term missions, goals for long-range technology development, lessons learned from existing flight detectors and new detector calibration, radiation and reliability issues.

Contributions are solicited in the following areas:

- Imaging spectrometer detectors in the 100 eV to 1MeV band
- Si CCDs
- Si pixel array detectors
- Compound semiconductor detectors
- Hybrid pixel array d*evices
- 3D detectors
- Microchannel Plate detector developments
- Cryogenic imaging spectrometers
- Calibration performance results from new detectors
- In-orbit detector performance and calibration issues from existing instruments
- Future detector developments for new instruments in X-ray Astronomy
- Radiation background and damage effects
- Multiple technology focal planes
- Polarimetric Detectors
- New detector readout strategies.

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